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United States Department of the Interior

GEOLOGICAL SURVEY
EROS Data Center
Sioux Falls, South Dakota 57198

IN REPLY REFER TO OAB12-99

December 30, 1983

Memorandum

To: Technical Officer

From: Principal Investigator AN 31

Subject: Quarterly Report; Landsat 4 Investigation of Thematic Mapper and Multispectral Scanner Applications (PCN902-91548; S-10757-C)

1) Problems

No problems occured this quarter.

2) Accomplishments

An experiment was started which is designed to merge as much scene information as possible into the red, green, blue layers of film, or channels of a video display, from four of the six reflective bands of TM data.

The TM scene of San Francisco (2/12/83, Path 44 Row 34) was selected for this experiment with test sites of rural Sacramento and the urban/rural interface around Berkeley. The study builds upon early results from three sources. The first source was Haas and Waltz, whose research indicated TM bands 3, 4, 5 were the combination which yield the most information for natural resource assessment in central South Dakota. The second source was Colvorcoresses who selected TM bands 1, 3, 5 for making an image map over the Washington, D.C. area with particular interest in urban areas and coastal waters. The third source was Chavez and his work with the Optimum Index Factor (OIF) which was used to evaluate six bands three at a time for a total of 20 combinations. The OIF placed TM bands 1, 4, 5 at the top of the list for most information contained in the Washington D.C. scene.

This study involves combining TM bands 1, 3, 4, 5, via Hue-Intensity-Saturation (HIS) transformation and replacement of the intensity channel with a fourth band. Attempts are being made to quantify information lost from replacement of the intensity band in this procedure. Secondary objectives are to present a color composite of "normal" colors which could be easily interpreted and to make stereo and perspective view images.

3) Significant Results

Six different band combinations, listed in Table 1, of TM data were selected for evaluation by four experienced photointerpreters. The interpreters were asked to rank the band combinations according to the ease with which they could distinguish the category of image feature designated for each set of combinacions. There were four sets of combinations selected for each category of image feature. Two TM scenes were used as test areas, both acquired August 12, 1983. The two scenes, 40392-16363 of the Oklahoma City, Oklahoma area and 40392-18144 of the Sacramento Valley, California area, were enlarged to 1:250,000 and 2cm circular chips were cut from each print. Each set ranked was composed of the identical area from the same scene in the six different band combinations.

A nonparametric rank order test was carried out on the data to determine if the interpreters found no difference among the band combinations in ranking for the designated categories. Kendall's coefficient of concordance (W) was calculated and the significance of the (W) value was determined by a chi-square test. Table 1 summarizes the results of the evaluation, and shows the rank order of band combinations indicated as valid by rejection of the null hypothesis.

4) Publications

Sadowski, F. G., Haas, R. H., Sturdevant, J. A., Anderson, W. H., Seevers, P. M., Feuquay, J. W., Balick L. K., Waltz, F. A., and Lauer, D. T., Study of thematic mapper and multispectral scanner data applications (Executive Summary): in Landsat 4 Third Workshop, Greenbelt, Maryland, 1983.

5) Recommendations

None

6) Data Utility

Some problems are becoming evident in the switch from Scrounge format to TIPS format. Test sites residing in two quadrants cause some extra effort in matching and mosaicking the test site together.

Donald T. Lauer

Table 1

Visual Interpretation of TM Band Combinations

Category	Ranking of Band Combinations (1) 234	123	235	345	543	347	Chi-square values
1. Urban features	1-2	6	5	4	1-2	3	29.920*
2. Water sediment patterns	2	1	3	5-6	4	5-6	59.680*
3. Field boundaries	2	6	4	3	5	1	22.857
4. Within field vegetative patterns	2	6	5	3	4	1	36.893*
5. Within field soil patterns	1	5	6	2-3	2-3	4	11.286
6. Water-vegetation boundaries	2	6	5	1	4	3	38.500*
7. Drainage patterns	1	6	2	5	4	3	20.286
8. Forest vegetation types	2	6	5	1	4	3	72.393*
9. Timber-grassland differentiation	1	6	2	4	5	3	54.893*
10. Small ponds	4	6	5	3	2	1	57.607*
11. Vegetative patterns in grassland	3	2	6	5	4	1	24.821
12. Marsh vegetation patterns	1	6	5	2	4	3	48.071*

* Significant at 0.05 level

(1) Color sequence of combinations was blue, green, red